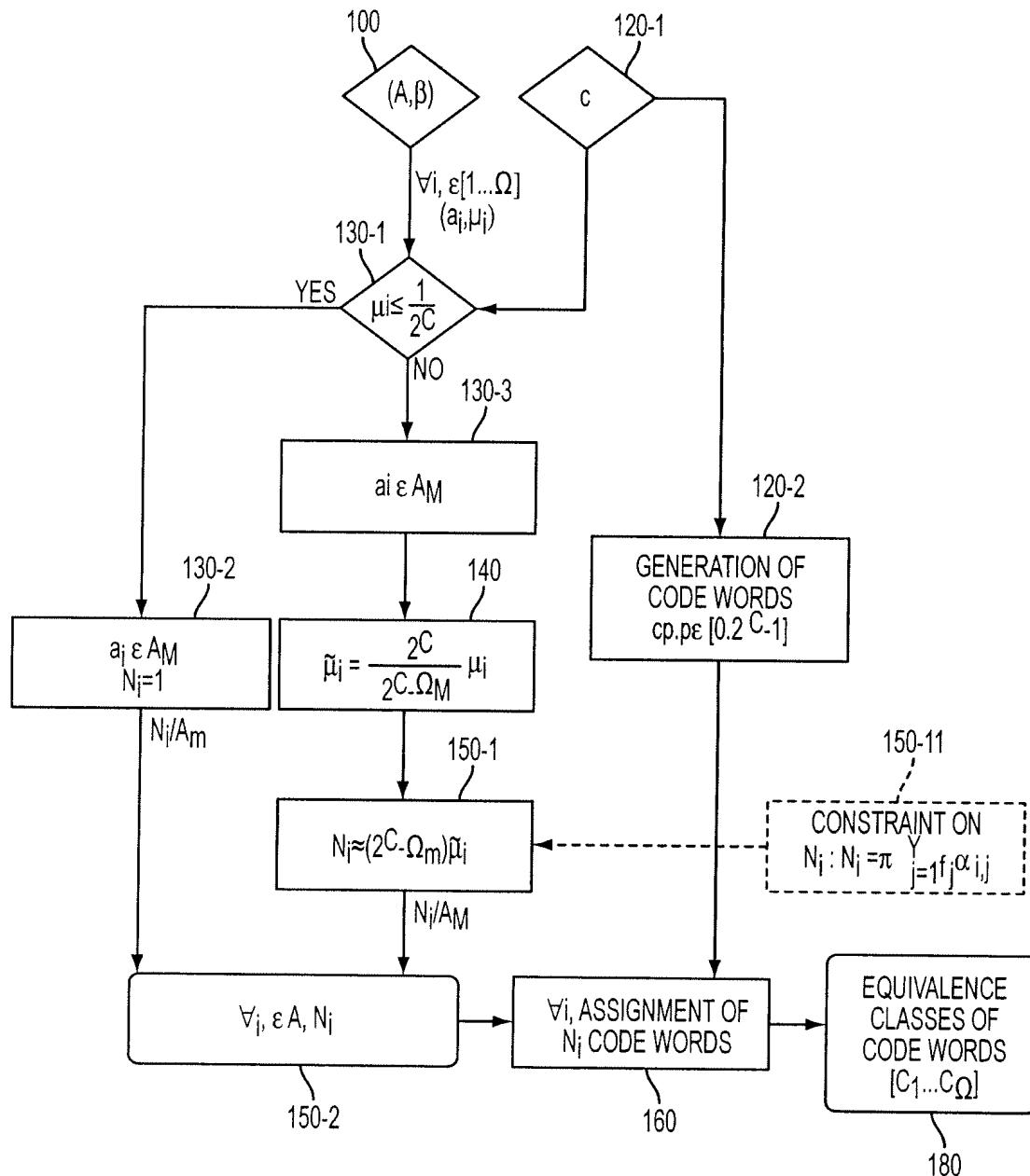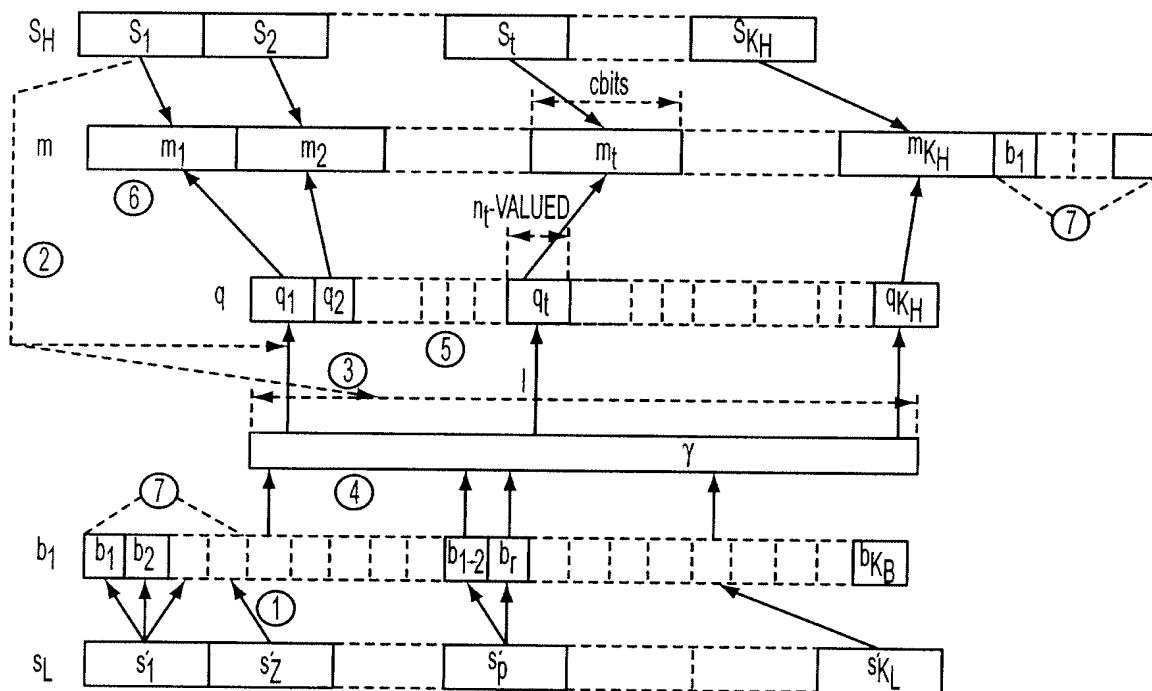Replacement Sheet
Title: DIGITAL DATA COMPRESSION
ROBUST RELATIVE TO
TRANSMISSION NOISE
Inventor(s): Herve JEGOU et al
Appl. No.: 10/521,963

100

(A,β)

$120\text{-}1$

c

$\forall i, \varepsilon[1...\Omega]$
(a_i,μ_i)

$130\text{-}1$

YES

$\mu i \leq \dfrac{1}{2^C}$

NO

$130\text{-}3$

$ai \, \varepsilon \, A_M$

$130\text{-}2$

140

$120\text{-}2$

$a_i \, \varepsilon \, A_M$
$N_i = 1$

$\tilde{\mu}_i = \dfrac{2^C}{2^C \cdot \Omega M} \, \mu_i$

GENERATION OF
CODE WORDS
$cp, p \varepsilon \, [0.2^{C}\text{-}1]$

N_i / A_m

$150\text{-}1$

$150\text{-}11$

$N_i \approx (2^C \cdot \Omega_m) \tilde{\mu}_i$

CONSTRAINT ON
$N_i : N_i = \pi \, {}^{\gamma}_{j=1} f_j{}^{\alpha}{}_{i,j}$

N_i / A_M

$\forall_i, \, \varepsilon \, A, \, N_i$

$\forall i$, ASSIGNMENT OF
N_i CODE WORDS

EQUIVALENCE
CLASSES OF
CODE WORDS
$[C_1...C_\Omega]$

$150\text{-}2$

160

180

FIG. 1

Replacement Sheet
Title: DIGITAL DATA COMPRESSION
ROBUST RELATIVE TO
TRANSMISSION NOISE
Inventor(s): Herve JEGOU et al
Appl. No.: 10/521,963

FIG. 2

CLASS C_i	CODE WORD $C_{i,q}$	SYMBOL a_i	N_i=CARD (C_i)	PROBABILITY μ_i	STATE q
C_1	0000 0001 0010 0011 0100 0101	a	6	0.43	0 1 2 3 4 5
C_2	0110 0111 1000 1001 1010	b	5	0.30	0 1 2 3 4
C_3	1011 1100 1101 1110	c	4	0.25	0 1 2 3
C_4	1111	d	1	0.02	0

FIG. 2A

Replacement Sheet
Title: DIGITAL DATA COMPRESSION
ROBUST RELATIVE TO
TRANSMISSION NOISE
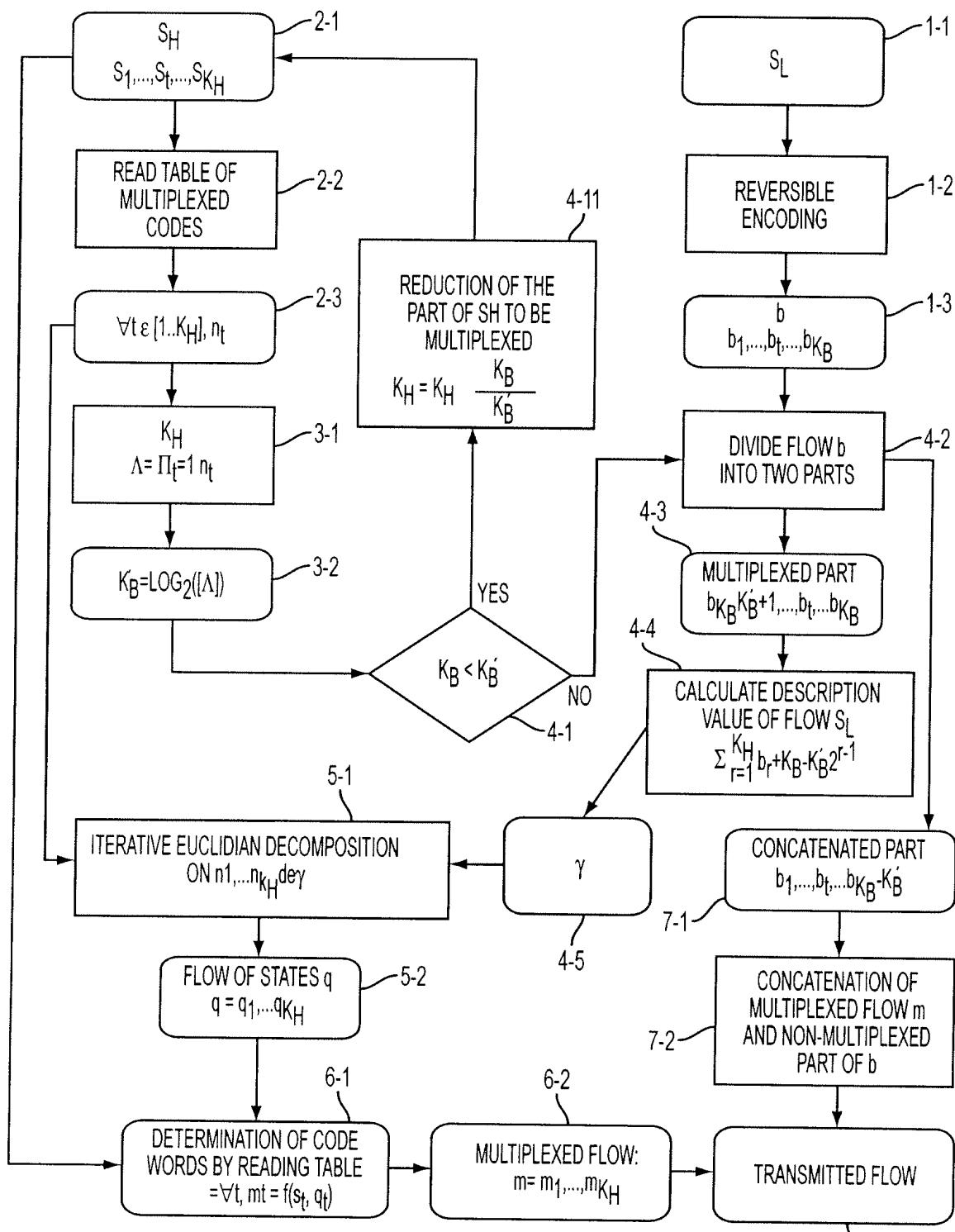Inventor(s): Herve JEGOU et al
Appl. No.: 10/521,963

S_H
$S_1,...,S_t,...,S_{K_H}$ — 2-1

READ TABLE OF MULTIPLEXED CODES — 2-2

$\forall t \varepsilon [1..K_H], n_t$ — 2-3

K_H
$\Lambda = \Pi_{t=1} n_t$ — 3-1

$K_B = LOG_2([\Lambda])$ — 3-2

REDUCTION OF THE PART OF SH TO BE MULTIPLEXED
$K_H = K_H \dfrac{K_B}{K_B'}$ — 4-11

$K_B < K_B'$ — 4-1
YES
NO

ITERATIVE EUCLIDIAN DECOMPOSITION ON $n1,...n_{k_H} de \gamma$ — 5-1

FLOW OF STATES q
$q = q_1,...q_{K_H}$ — 5-2

γ — 4-5

DETERMINATION OF CODE WORDS BY READING TABLE
$= \forall t, mt = f(s_t, q_t)$ — 6-1

MULTIPLEXED FLOW:
$m = m_1,...,m_{K_H}$ — 6-2

S_L — 1-1

REVERSIBLE ENCODING — 1-2

b
$b_1,...,b_t,...,b_{K_B}$ — 1-3

DIVIDE FLOW b INTO TWO PARTS — 4-2

MULTIPLEXED PART
$b_{K_B}K_B'+1,...,b_t,...b_{K_B}$ — 4-3

CALCULATE DESCRIPTION VALUE OF FLOW S_L
$\sum_{r=1}^{K_H} b_r + K_B - K_B' 2^{r-1}$ — 4-4

CONCATENATED PART
$b_1,...,b_t,...b_{K_B}-K_B'$ — 7-1

CONCATENATION OF MULTIPLEXED FLOW m AND NON-MULTIPLEXED PART OF b — 7-2

TRANSMITTED FLOW — 7-3
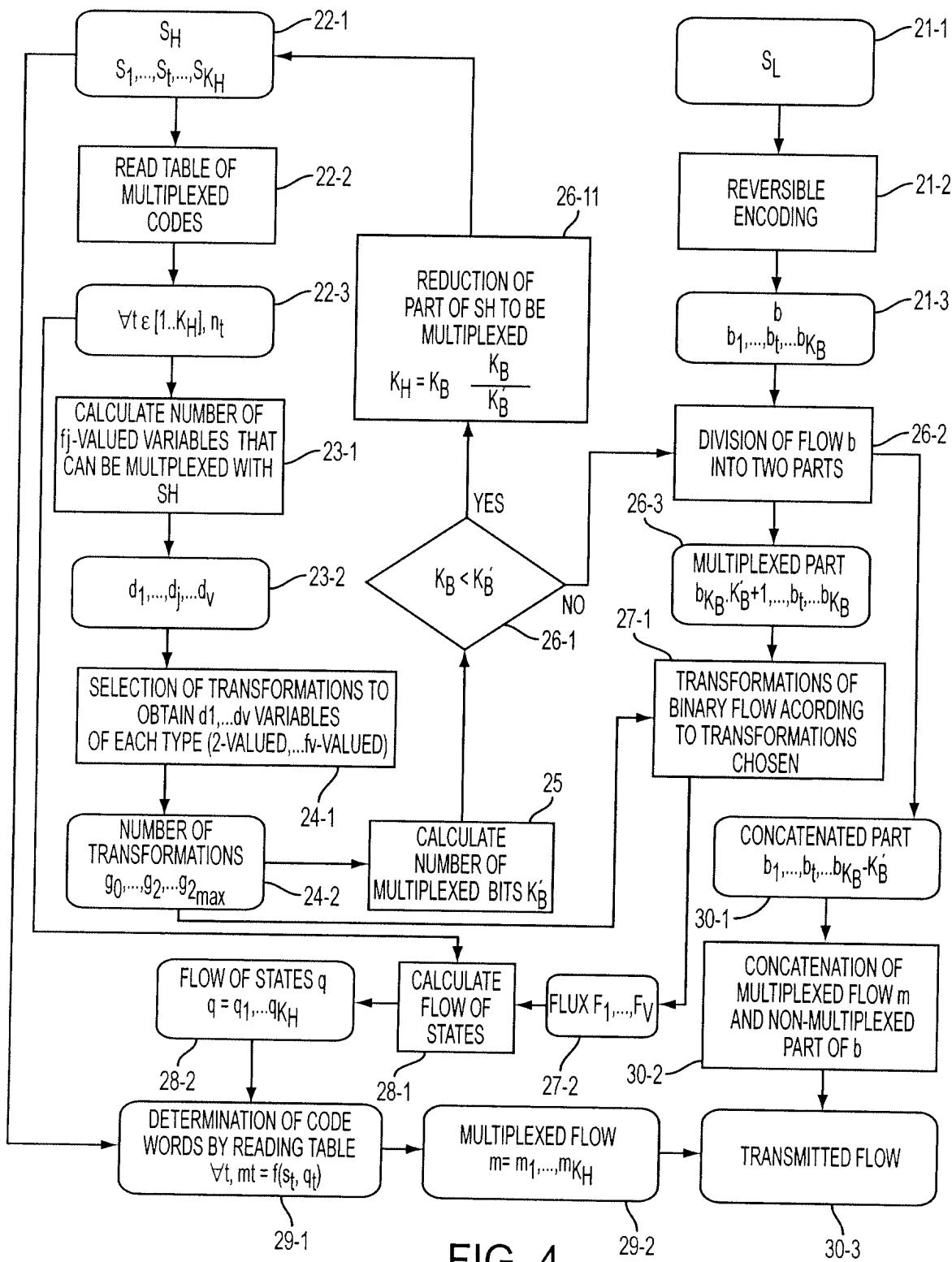
FIG. 3

Replacement Sheet
Title: DIGITAL DATA COMPRESSION
ROBUST RELATIVE TO
TRANSMISSION NOISE
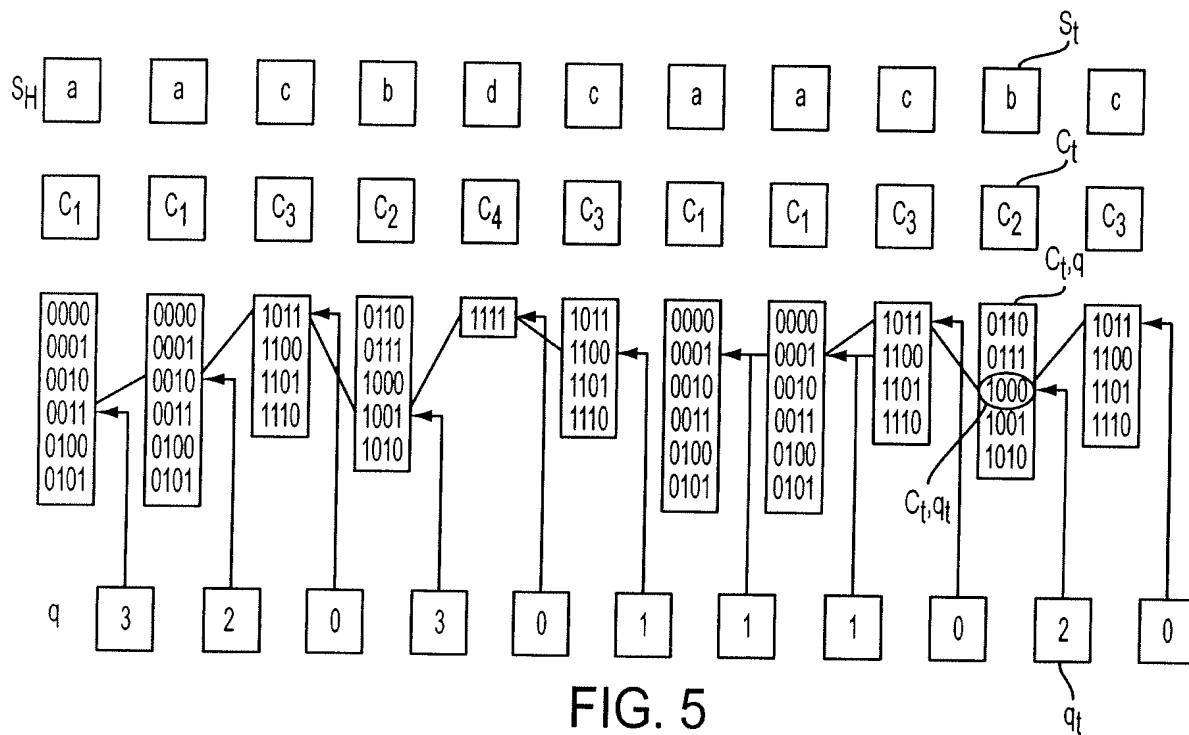Inventor(s): Herve JEGOU et al
Appl. No.: 10/521,963

S_H
$S_1,...,S_t,...,S_{K_H}$ — 22-1

S_L — 21-1

READ TABLE OF
MULTIPLEXED
CODES — 22-2

REVERSIBLE
ENCODING — 21-2

$\forall t \in [1..K_H], n_t$ — 22-3

b
$b_1,...,b_t,...b_{K_B}$ — 21-3

CALCULATE NUMBER OF
f_j-VALUED VARIABLES THAT
CAN BE MULTPLEXED WITH
SH — 23-1

REDUCTION OF
PART OF SH TO BE
MULTIPLEXED

$K_H = K_B \dfrac{K_B}{K_B'}$ — 26-11

DIVISION OF FLOW b
INTO TWO PARTS — 26-2

$d_1,...,d_j,...d_V$ — 23-2

YES

$K_B < K_B'$ — 26-1

NO

MULTIPLEXED PART
$b_{K_B}.K_B'+1,...,b_t,...b_{K_B}$ — 26-3

SELECTION OF TRANSFORMATIONS TO
OBTAIN $d_1,...d_V$ VARIABLES
OF EACH TYPE (2-VALUED,...f_V-VALUED) — 24-1

27-1

TRANSFORMATIONS OF
BINARY FLOW ACORDING
TO TRANSFORMATIONS
CHOSEN

NUMBER OF
TRANSFORMATIONS
$g_0,...,g_2,...g_{2max}$ — 24-2

CALCULATE
NUMBER OF
MULTIPLEXED BITS K_B' — 25

CONCATENATED PART
$b_1,...,b_t,...b_{K_B}-K_B'$

30-1

FLOW OF STATES q
$q = q_1,...q_{K_H}$

CALCULATE
FLOW OF
STATES — 28-1

FLUX $F_1,...,F_V$ — 27-2

CONCATENATION OF
MULTIPLEXED FLOW m
AND NON-MULTIPLEXED
PART OF b — 30-2

28-2

DETERMINATION OF CODE
WORDS BY READING TABLE
$\forall t, mt = f(s_t, q_t)$ — 29-1

MULTIPLEXED FLOW
$m = m_1,...,m_{K_H}$ — 29-2

TRANSMITTED FLOW — 30-3

FIG. 4

Replacement Sheet
Title: DIGITAL DATA COMPRESSION
ROBUST RELATIVE TO
TRANSMISSION NOISE
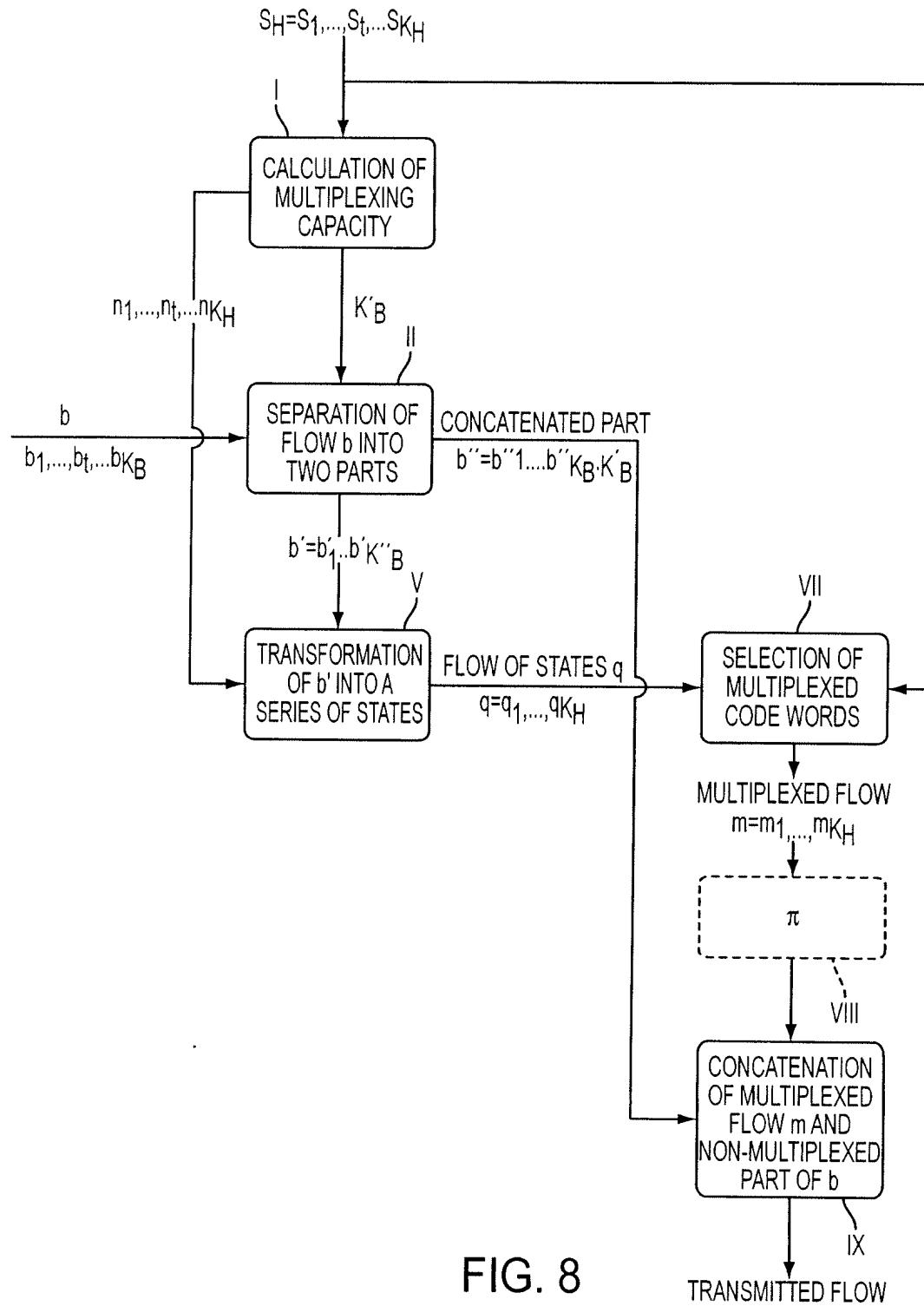Inventor(s): Herve JEGOU et al
Appl. No.: 10/521,963

FIG. 5

T_Z IDENTIFIER	U_{T_Z}	$V_{T_Z,1}$	$V_{T_Z,2}$	$V_{T_Z,3}$	O_{T_Z}
T_0	1	1	0	0	0.0000
T_1	15	0	8	1	0.0001
T_2	21	0	3	7	0.0004
T_3	19	0	12	0	0.0010
T_4	25	0	7	6	0.0011
T_5	24	0	2	9	0.0028
T_6	14	0	3	4	0.0030
T_7	18	0	7	3	0.0034
T_8	27	0	1	11	0.0047
T_9	17	0	2	6	0.0060
T_{10}	30	0	0	13	0.0062
T_{11}	20	0	1	8	0.0080
T_{12}	11	0	7	0	0.0086
T_{13}	23	0	0	10	0.0095
T_{14}	6	0	1	2	0.0381
T_{15}	3	0	2	0	0.0566
T_{16}	2	0	0	1	0.1610
$T_{Z_{max}} = T_{17}$	1	0	1	0	0.5850

FIG. 6

Replacement Sheet
Title: DIGITAL DATA COMPRESSION
ROBUST RELATIVE TO
TRANSMISSION NOISE
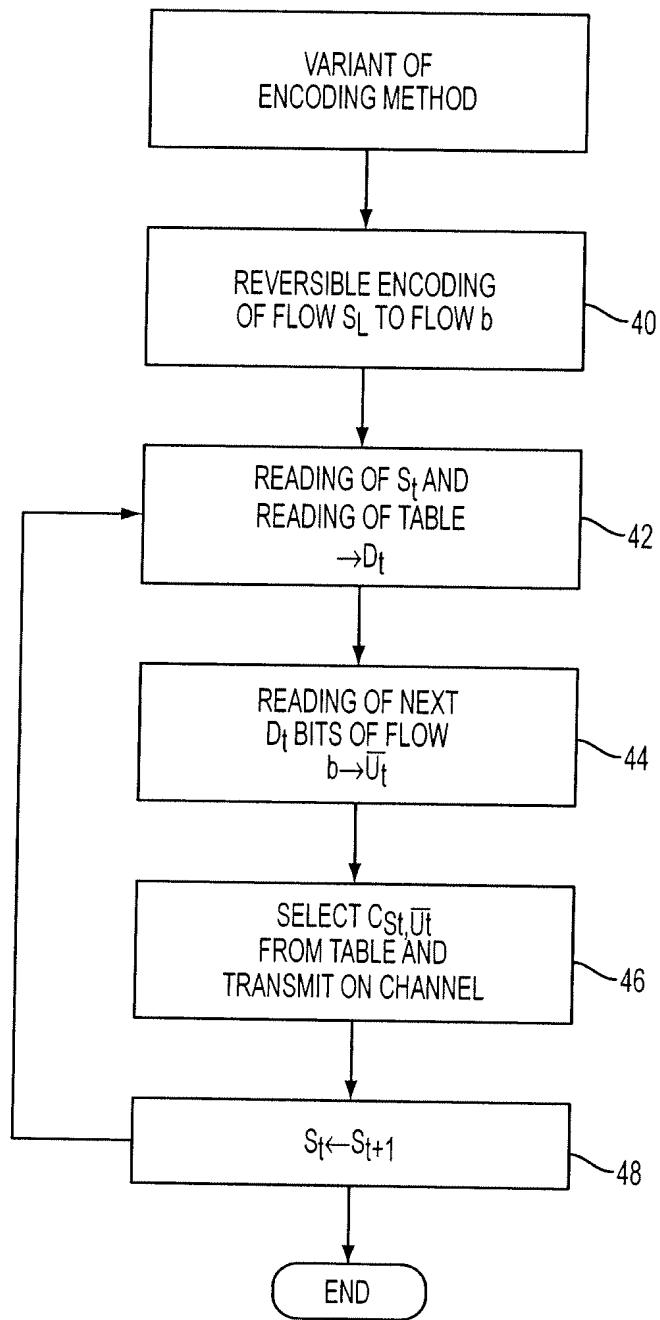Inventor(s): Herve JEGOU et al
Appl. No.: 10/521,963

$S_H = S_1,...,S_t,...S_{K_H}$

I

CALCULATION OF
MULTIPLEXING
CAPACITY

$n_1,...,n_t,...n_{K_H}$

K'_B

II

b

$b_1,...,b_t,...b_{K_B}$

SEPARATION OF
FLOW b INTO
TWO PARTS

CONCATENATED PART

$b'' = b''_1....b''_{K_B \cdot K'_B}$

$b' = b'_1...b'_{K''_B}$

V

TRANSFORMATION
OF b' INTO A
SERIES OF STATES

FLOW OF STATES q

$q = q_1,...,q_{K_H}$

VII

SELECTION OF
MULTIPLEXED
CODE WORDS

MULTIPLEXED FLOW

$m = m_1,...,m_{K_H}$

π

VIII

CONCATENATION
OF MULTIPLEXED
FLOW m AND
NON-MULTIPLEXED
PART OF b

IX

FIG. 8

TRANSMITTED FLOW

Replacement Sheet
Title: DIGITAL DATA COMPRESSION
ROBUST RELATIVE TO
TRANSMISSION NOISE
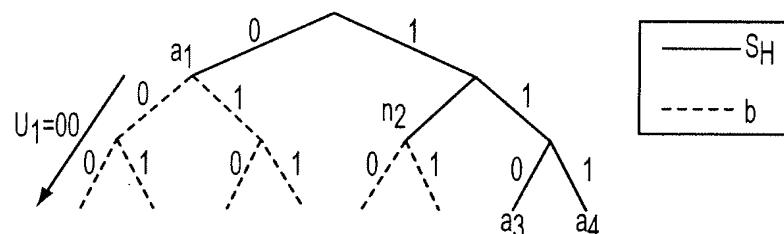Inventor(s): Herve JEGOU et al
Appl. No.: 10/521,963

VARIANT OF
ENCODING METHOD

REVERSIBLE ENCODING
OF FLOW S_L TO FLOW b ──40

READING OF S_t AND
READING OF TABLE
→D_t ──42

READING OF NEXT
D_t BITS OF FLOW
$b→\overline{U}_t$ ──44

SELECT $C_{S_t,\overline{U}_t}$
FROM TABLE AND
TRANSMIT ON CHANNEL ──46

$S_t←S_{t+1}$ ──48

END

FIG. 9

	11-B	12-B	13-B	18-B	14-B	15-B	17-B
	CLASS C_i	$C_i, \overline{U_i}$	a_i	D_i	$N_i = Z^{1i}$	μ_i	$\overline{U_i}$
B	C_1	000	a_1	1	2	0.30	0
		001					1
	C_2	010	a_2	2	4	0.43	00
		011					01
		100					10
		101					11
	C_3	110	a_3	0	1	0.25	Ø
	C_4	111	a_4	0	1	0.02	Ø

FIG. 2B

FIG. 7

S_t	a_2	a_1	a_1	a_3	a_1	a_2	a_1	a_4	a_2	a_1
PREFIX	10	0..	0..	110	0..	10.	0..	111	10.	0..
SUFFIX $\overline{U_t}$	..0	..10	.10	...	.10	.1	.01	...	..0	.10
m_t	100	010	010	110	010	101	001	111	100	010

FIG. 10

Replacement Sheet
Title: DIGITAL DATA COMPRESSION
ROBUST RELATIVE TO
TRANSMISSION NOISE
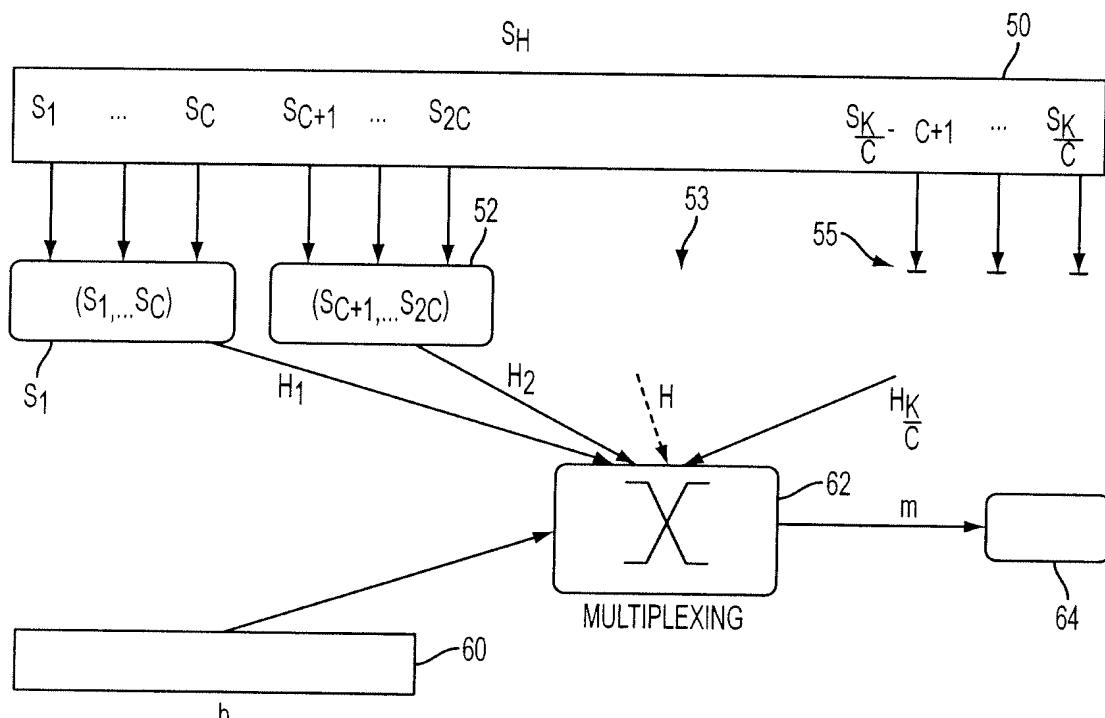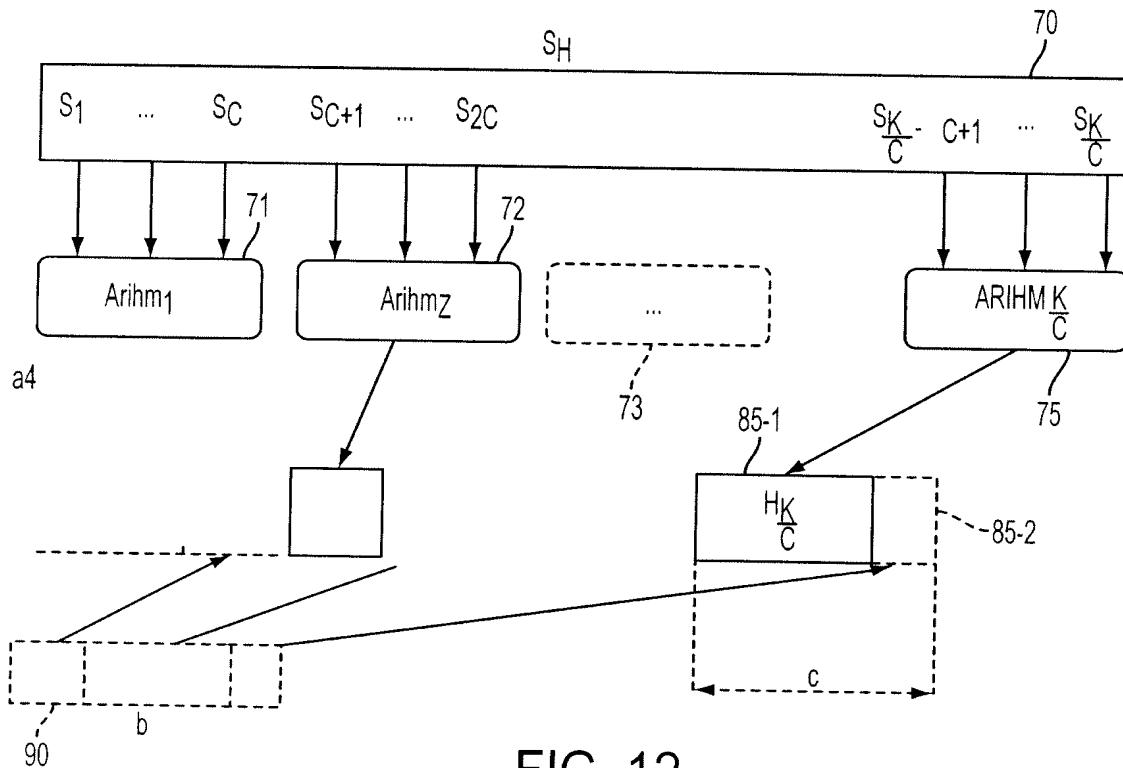Inventor(s): Herve JEGOU et al
Appl. No.: 10/521,963

S_H 50

| S_1 ... S_C | S_{C+1} ... S_{2C} | | $S_{\frac{K}{C}-C+1}$ ... $S_{\frac{K}{C}}$ |

53

55

$(S_1,...S_C)$ $(S_{C+1},...S_{2C})$ 52

S_1 H_1 H_2 H $H_{\frac{K}{C}}$

X   62   m

MULTIPLEXING

64

60

b

FIG. 11

S_H 70

| S_1 ... S_C | S_{C+1} ... S_{2C} | | $S_{\frac{K}{C}-C+1}$ ... $S_{\frac{K}{C}}$ |

$Arihm_1$ 71 $Arihm_Z$ 72   ... $ARIHM\frac{K}{C}$

a4

73   85-1   75

$H_{\frac{K}{C}}$ 85-2

c

90   b

FIG. 12